Title: "A MACHINE FOR STACKING ARTICLES"

***

Field of the invention

The present invention relates to a machine for the orderly positioning of stackable articles and, in particular, a machine for forming stacks, constituted of a pre-established number of articles, which are subsequently transferred to subsequent processing stations, for example finishing and/or packaging stations.

Background art

A machine according to the present invention can for example be utilized in thermoforming plants designed to produce hollow articles, such as cups, plates, trays or other such disposable products. These articles are produced from one or more thermoformable materials, such as polystyrene, polypropylene, polyethylene or the like, which are extruded in the form of a continuous sheet. The articles formed and separated from the rest of the sheet are collected in stacks and transferred to subsequent processing phases, for example edging for cups or packaging in the case of other articles.

The machines for forming and transferring stacks in thermoforming plants must firstly guarantee the continuity of execution of production cycles. In other words, the stacks must be transferred without necessarily having to interrupt the production cycles of the articles.

An example of a prior art stacking machine of this type is described for example in the patent application n. EP 1125717. In this machine the articles ejected from the mould are deposited on special guides essentially horizontal, or slightly inclined, and stacked directly with the previously produced articles. Upon completion of the stacks with the pre-established number, they are transferred to a subsequent processing station.

Nonetheless, these prior art systems have several drawbacks. To transfer and stack the formed articles noteworthy mechanical handling of these articles is required. In fact, mechanical stop systems, such as hooks, brushes or bosses positioned on the guides, must be utilized to hold the articles stacked on the horizontal or slightly inclined guides.

These prior art solutions can also cause damage to the articles, for example crushing of the last articles stacked that have to sustain the strength of the rest of the stack in front of them and of the relative mechanical stop systems. On the other hand, these solutions actually prevent an effective compacting of the stacks before they are transferred to a subsequent processing station.

Moreover, considering that the majority of articles produced with the thermoforming technology are destined for use with foods, the amount of mechanical handling can also cause noteworthy problems concerning hygiene.

The solution of essentially horizontal stacking, or in any case directly in alignment with the thermoforming station, also means that the machine has noteworthy overall dimensions with respect to the rest of the plant and makes handling of the articles and of the stacks complex.

Summary of the invention

The task of the present invention is therefore to provide a machine for stacking and transferring stackable articles wherein the drawbacks of prior art can be solved.

Within the scope of this task, a particular object of the present invention is to provide a machine for stacking thermoformed articles wherein mechanical handling of the thermoformed articles during the stacking phase of the articles produced can be limited as much as possible or even eliminated.

Another object of the present invention is to provide a machine of

the aforesaid type wherein correct stacking of the articles and effective compacting of the articles of each stack can be produced.

A further object of the present invention is to provide a machine of the aforesaid type which is of simple construction and operates reliably.

These objects are attained by the present invention, which relates to a machine for the orderly positioning and transfer of stackable articles according to claim 1. Further advantageous characteristics of the machine are indicated in the dependent claims.

The machine according to the invention includes at least one station to receive the articles and at least one station to form stacks. The station to form stacks includes at least one container equipped with a plurality of essentially vertical compartments designed to receive the articles and to promote their stacking through gravity.

Stacking of the articles is thus performed above all through gravity, hence limiting mechanical handling of the products during forming of the stacks.

The container is preferably movable between a position wherein the articles are accumulated and one or more positions wherein the stacks of articles formed are released.

In particular, at least two containers are provided, movable so that when one of the two containers is held in the position to accumulate the articles, the other of the two containers is in at least one stand-by position or in the aforesaid one or more positions to release the stacks, or vice versa. In this way transfer of the stacks already formed can take place without interfering with forming the stacks of articles delivered from the machine. The machine is also particularly compact with respect to prior art machines.

The containers are preferably mounted on a frame rotatable in diametrally opposed positions with respect to the axis of rotation of the

frame. First handling means are provided to operate the frame in rotation when the positions of the containers require to be inverted. This solution is particularly simple and reliable both from the constructional and from the operational viewpoint.

Second handling means are also provided, which allow the containers to translate with respect to the frame. More specifically, these second handling means include a single motor and are designed to prevent translation of the container that is in the position to accumulate the articles and to enable translation of the other container between the stand-by position and the various positions to release the stacks. Also from this aspect a single motor is used, which acts on only one of the two containers at a time. In this way, complex kinematic handling systems typical of prior embodiments can be avoided.

Associated with each of the containers is a bottom element positioned under the respective container on which the stacks are placed. Advantageously, vibration means are provided for at least the bottom element associated with the container in the position to accumulate the articles. The stacks being formed that are placed on the bottom of the container in the accumulation position are therefore subjected to vibrations to facilitate correct forming and compacting.

Brief description of the drawings

Further characteristics and advantages of the present invention shall become clearer from the description hereunder, provided with reference to the accompanying drawings, wherein:

- Figure 1 is a simplified axonometric view of a machine according to the present invention;

- Figure 2 is a view of a portion of the machine according to the present invention, with some parts omitted for clarity;

- Figure 3 is an elevation view showing the two containers in different

positions in the portion of the machine represented in Figure 2;

- Figure 4 is a cross section view of the portion of the machine represented in Figure 2, wherein some of the means are shown to operate the containers in translation;

- Figure 5 is a cross section view showing the means to produce vibrations in the bottom associated with a container;

- Figure 6 is a top plan view of the system to temporarily halt the articles that reach the collection container; and

- Figure 7 is an elevation view of the unit including the receiving station and the members to guide the articles towards the collection container.

Modes for carrying out the invention

The figures represent a machine for orderly positioning and transfer of cups according to a possible embodiment of the present invention.

The machine can preferably be translated in its entirety out of the production line by providing wheels 4 fixed to the base 3 and which slidably engage with transverse rails 5. Moreover, motorizing means (not shown) are preferably provided to act on one or more of the wheels 4 to allow the machine to be moved and correctly repositioned with respect to the rest of the plant.

The machine essentially includes a receiving station 10 to which cups are carried (arrow B) after being formed and separated from the rest of the sheet of plastic material.

A plurality of ducts 11 are provided in the receiving station 10, wherein a condition of vacuum pressure is produced, capable of drawing by suction the formed articles delivered to the machine and directing them towards a corresponding plurality of guide members 20, formed for example of a plurality of suitably bent bars.

The assembly including the receiving station 10 and the guide

members 20 - represented in greater detail in Figure 7 - is shown in Figure 1 in the operating position and is supported on a supporting structure 1. This assembly can preferably translate along the structure 1, for example utilizing pneumatic actuators 2, so that it can be moved to a rearwards non-operating position (towards the right side in Figure 1) to facilitate frontal access to the lower parts of the machine during maintenance operations and to check that the articles are correctly formed during the start up phases of the plant, that is prior to starting production and enabling stacking of the articles.

The cups channelled through the guide members 20 are collected and stacked in a container 30a to form stacks including a pre-established number of articles. In the embodiment illustrated herein two containers 30a and 30b are provided mounted on a rotatable frame 40 in positions diametrally opposed with respect to the axis of rotation of the frame. As can be seen, the axis of rotation A (Figure 3) of the frame is inclined with respect to the supporting base 3 of the machine.

In Figure 1 the container 30a is in the position to accumulate the cups while the container 30b is in a position defined as "stand-by position", that is the position occupied by the container before (or after) being translated to the various positions to release the stacks onto a conveyor belt 6.

Reference shall now also be made to the subsequent Figures 2 to 4, wherein some characteristics of the handling systems of the rotatable frame 40 and the containers 30a and 30b are shown in greater detail.

The view in Figure 2, wherein the frame is shown without containers and rotated through 90° with respect to the position in Figure 1, shows two geared motors 31 and 41 used respectively to perform translation of the containers and rotation of the frame 40. Both geared motors 31 and 41 are controlled by a local or centralized control unit (not shown) to

guarantee synchronism with the production cycle of the thermoforming station.

The geared motor 41 transmits movement to a hollow shaft 42, integral with the frame 40, for example by means of a transmission system with chain or toothed belt 43 to allow the entire frame 40 to rotate upon command. This allows the position of the containers 30a and 30b to be inverted when the forming of stacks by loading the pre-established number of cups has been completed in one of them.

The geared motor 31 transmits movement to a shaft 32 disposed inside the hollow shaft 42 in a position coaxial and rotatable separately with respect to the same. Movement can be transmitted for example by means of a system with a toothed belt or chain 33. The shaft 42 transmits movement to a distribution box 34 to move, through respective toothed belts or chains, a pair of parallel shafts 35 (Figure 4) provided with brake 37 and clutch 36 mechanisms.

These mechanisms operated upon the command of the single geared motor 31 are used to translate only one of the two containers, that is the one that is above the conveyor belt 6, to move it in steps between the stand-by position and the various positions to release the stacks on the belt 6. In particular, the brake and clutch mechanisms 36 allow translation of the container in the accumulation position of the cups (container 30a in Figure 1) to be disabled and stepped translation of the other container (container 30b in Figure 1) to be enabled between the stand-by position and the one or more positions to release the stacks on the conveyor belt 6.

Each container 30a and 30b is connected to toothed belts 45 positioned outside the frame 40 (Figures 1 and 2) by means of fixing clamps 46 that pass through slots 47 produced in the side walls of the frame. Also connected to each of the clamps 46 is the movable element

of a position sensor 48 (only one of which can be seen in Figure 2), such as a linear potentiometer or any other device capable of supplying a signal that indicates the position of the container during translation.

In the view of Figure 3 the container 30b is shown in one of the positions to release the stacks and, more specifically, in the outermost position wherein the last stacks are unloaded from the container 30b. In fact, the last row of compartments 39 of the container 30b in Figure 3 is positioned beyond the bottom element 53b associated with the container 30b.

As can be seen also in the plan view in Figure 4, wherein only the container 30a is represented, each container includes a plurality of compartments disposed according to a matrix (in this case five rows of nine compartments) and a single stack is formed in each compartment.

When the stacks are released, the container is made to translate in steps between a stand-by position, in which all the compartments are obstructed at the bottom by the bottom element 53b, to a first release position wherein all the stacks of one row of the container are deposited simultaneously on the conveyor belt 6. Stepped advancement continues until the last row of compartments 39 of the container 30b has also passed beyond the associated bottom element 53b.

The bottom elements 53a and 53b associated with the respective containers 30a and 30b are connected to the frame 40 by elastic means. This allows vibrations to be produced in the bottom element of the container in the collecting position to facilitate correct stacking of the cups.

The means to produce said vibrations are shown in Figure 3 and are represented in greater detail in Figure 5, which shows a motor or geared motor 51 that transmits movement to a pair of eccentric rolls 52 through toothed belts. The eccentric rolls 52 are placed in contact with the

bottom wall 53a of the container 30a. A pneumatic actuator 55, better seen in Figure 3, allows the eccentric rollers 52 to be held in contact with the bottom element 53a during collection and forming of the stacks in the container 30a, and allows the rollers to be disengaged from their operating position during rotation of the frame 40 and consequent inversion in the position of the containers 30a and 30b.

Figure 6 shows means 60 that obstruct or selectively allow access of the cups to a container during operation of the machine. In fact, in order not to halt operation of the system during inversion of the position of the containers 30a and 30b, the cups must be temporarily held inside the guide elements 20, at least until an empty container is positioned under them in the correct position to pick up the cups. For this reason, the means 60 are disposed at the end of the defined path of the guide elements 20 as shown in greater detail in Figure 7.

Returning to Figure 6, the means 60 include a plurality of stop elements 65 mounted on rods parallel to one another and operated simultaneously by a single pneumatic actuator 61 by means of a series of links 64. In the position shown in Figure 6 the stop elements are deactivated and therefore do not prevent the cups from travelling through the circular shapes 66. When the flow of cups requires to be halted, a command is given to the pneumatic actuator 61 to carry all the stop elements 65 simultaneously to a position of interference with the circular shapes 66. In this case, each circular shape 66 will be partially obstructed by a pair of stop elements 65 in positions diametrally opposed from each other.

Various modifications and improvements may be made without departing from the scope of the present invention.

For example, in the embodiment shown, the compartments of each of the containers preferably have the same number and the same

layout as the cavities of the mould in which the cups are formed. Nonetheless, the number and layout of the compartments in each container can also be chosen differently, or more than two containers to form the stacks can be provided.

Moreover, although an embodiment has been described wherein the formed articles are cups, the machine according to the present invention may also be utilized for various articles, such as plates, trays or the like, or even for stackable articles obtained with procedures different to thermoforming.